DOCUMENT RESUME

ED 180 935 SP 014 222

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TITLE The Effect of Strength Training on Fractionalized Accuracy.
PUB DATE 79
NOTE 7p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Muscular Strength; *Perceptual Motor Coordination; *Psychomotor Skills; *Success Factors; *Task Performance
IDENTIFIERS *Precision Tasks

ABSTRACT

The role of the strength factor in the accomplishment of precision tasks was investigated. Forty adult males weight trained to develop physical strength in several muscle groups, particularly in the elbow flexor area. Results indicate a decrease in incidence of accuracy concurrent with an increase in muscle strength. This suggests that in order to avoid over-training, motor skills should be practiced as the strength change occurs. (LH)

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THE EFFECT OF STRENGTH TRAINING ON FRACTIONALIZED ACCURACY

C. Eric Gronbech

Introduction

Any time an accuracy task is presented, it necessitates a working together of both our perceptual and motor systems. The degree of efficiency with which we bring about the desired precise outcome and our ability to repeat this accurate performance time after time necessitates incorporating the desired perceptual-motor change. Accuracy necessitates proper perception, computation and response for success. Any lack of success may be identified in either a directional sense, a distance sense or any combination of both. To have accurate direction a subject must time his release relative to the position in the arc at which the projection occurs. To be accurate in distance the performer must call forth the correct magnitude of force accomplished through the recruitment of the proper number of motor units in the most efficient combinations. It was the purpose of this experiment to investigate one factor involved in the complex neuro-motor coordination necessary for successful performance in an accuracy task. That factor being the strength of the muscle fibers associated with the motor neurons activated to bring about the prescribed response.

There are two possibilities concerning this strength, the weakening of the force due to fatigue, atrophy or pathology contracted after the task was learned or the increase in strength of the muscle fibers resulting from training. This study was undertaken to test the hypothesis that weight training which brought about a significant increase in strength of the muscles directly responsible for accurate repetition of a task without accompanying exercise in that task, would have a detrimental affect on the reproduction of the previous level of performance. This study was further designed to test the duration of this effect and its long term affect on accuracy based on a second theory; the increased strength of the fibers would permit the afore learned task to be accomplished with fewer motor units thereby eliminating some complexity in the neuromotor coordination.

Procedure

Forty adult male volunteers were trained for five days to exert a force equal to fifty percent of the maximum strength, in the flexors of the dominant arm, isometrically against a dynamometer fixed to limit the elbow at ninety degrees of flexion. Following training, the group was tested then randomly assigned to either a treatment or a control group. For the next seven weeks the treatment group trained to increase the strength in the elbow flexors. After the treatment period the subjects were retested for strength, and on the task to determine the extent to which the pervious level of performance was retained. After the post tests, the subjects were again retrained. The pre and post test scores and the post training scores were recorded for each subject. These scores, as well as the pretreatment

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and post treatment maximal strength scores, were subjected to the appropriate ANOVA to determine the effectiveness of the treatment program and its affect on performance in the task.

Two ANOVA with repetition on treatments were computed. A Tukey's procedure was utilized to locate any statistical significance indicated. The alfa level was set at .05 for all comparisons.

Results

A. Strength Program (Treatment)

1. There was no significant difference between the groups in elbow flexor strength on the pretest.

2. There was no significant increase in elbow strength from the pre to the post test for the control group.

3. There was a significant increase in elbow flexor strength from the pre to the post test for the treatment group.

4. There was a significant difference between the groups in elbow flexor strength on the post test.

B. Accuracy in Strength Evocation

1. There was no significant difference between the groups in absolute error on the pretest.

2. There was a significant increase in absolute error from the pre to the post test for the control group. (Lack of retention).

3. There was a significant increase in absolute error from the pre to the post test for the treatment group. (lack of retention).

4. There was a significant difference between the groups in absolute error on the post test.

C. Post Training Period

1. From the post test until approximately the middle of retraining, the control group improved slightly. From approximately the middle of the retraining period until the end there was a decrease in performance (increased error).

2. From the post test until the end of the post training period the performance of the treatment group continually improved.

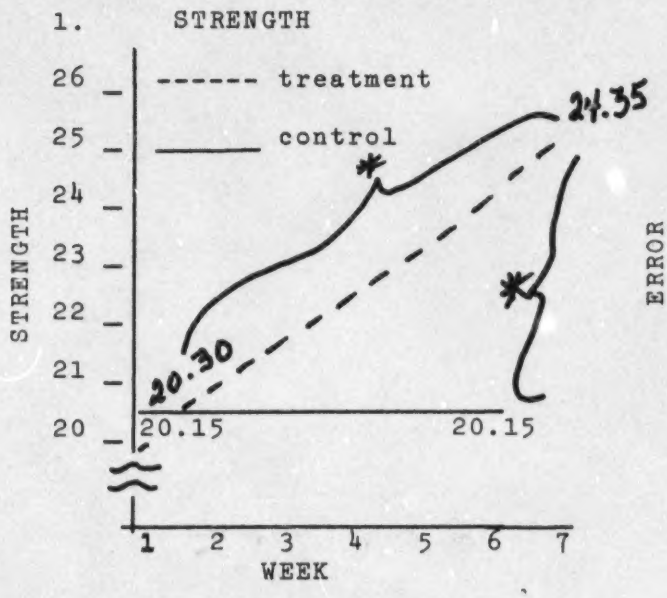
3. The treatment group performed better than the control group from approximately trial #70 through trail #100.

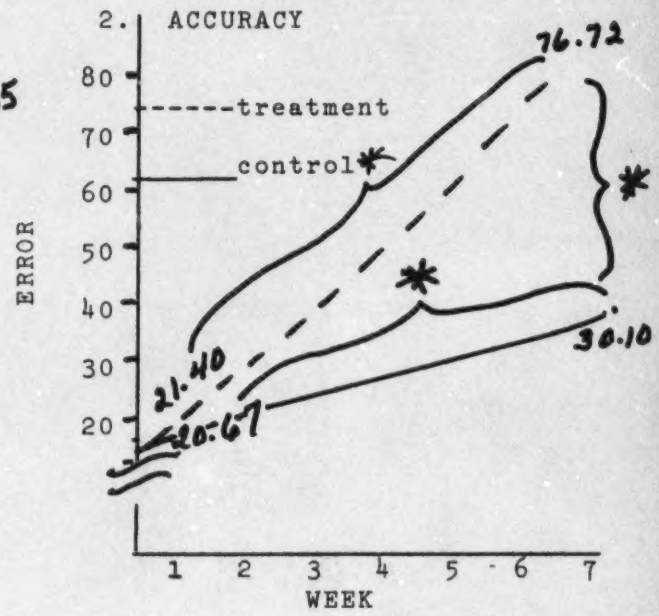
CONCLUSION

1. The strength training program was successful in bringing about a significant increase in the strength of the elbow flexors for the treatment group.

2. The increased strength had a significant initial detrimental effect on the performance of the treatment group in the task.

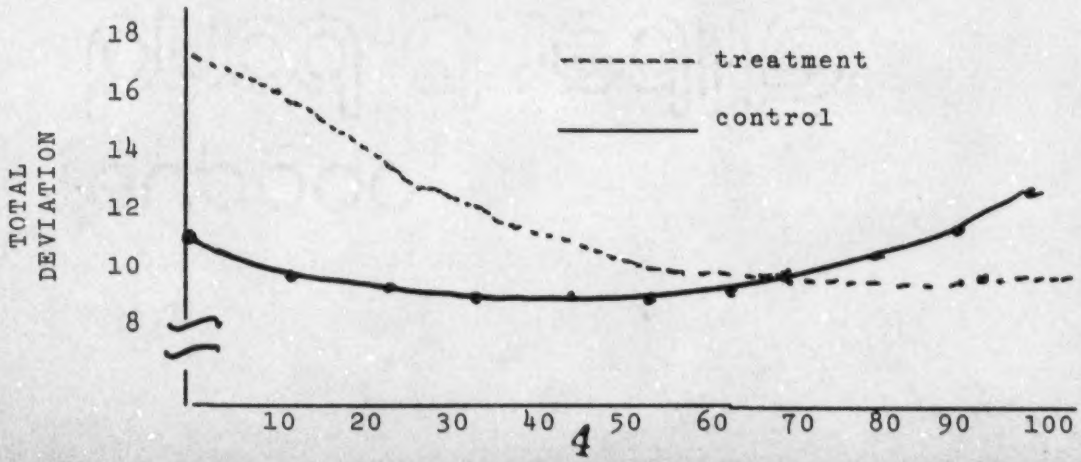
3. The long term affect of an increase in strength brought about greater accuracy in the task, for the treatment group by the end of the retraining period.





* Significant at .05

3. POST TRAINING



Discussion and Recommendations

Theoretically the results may be explained relative to motor memory and neuromotor coordination. The initial detrimental affect may be caused by the subject learning to perform the task with a given number of motor units in specific combination. The more skilled the subject the better he has learned, and the more precise his perception, computation and execution. When he gains strength each muscle fiber associated with an active motor unit is stronger and when memory calls for a previously learned program the response, consistent with the all or none law, is an output of too much force. This increased error has a detrimental effect on the performance.

The long term improvement in performance may well be due to the increase in the strength of each muscle fiber associated with an active motor unit as well. With greater force possible from the learned program, it becomes necessary to adapt to the new strength. The original response, skilled performance, may now be successfully accomplished more efficiently with fewer motor units or units structured for finer motor function.

Weight training also brings about additional contributory physiological effects.

1) An increase in mypglobin enhancing the ability of a trained muscle to withstand fatigue;

2) A decrease in the ischemic effect on the efficiency of the transport system;

3) A decrease in random electrical activity and irrelevant contraction;

4) A decrease in unit firing and the treppe phenomena;

5) A lower energy cost.

In practicality, if the accuracy skill is practiced as the strength change occurs, the adaptation will be gradual and the detrimental effect almost eliminated. The program will be continually updated and the facilitating effect incorporated in practice.

For many years coaches have been aware of a similar, temproary yet opposite affect. Anyone who has participated in heavy resistance training immediately preceding performance in an accuracy task or has been called on to shoot a foul shot late in a game, or throw strikes after he has pitched 8 hard innings, has encountered the affect fatigue, a temporary decrease in strength, has on accuracy. It is now common procedure to distribute foul shots or shooting drills throughout a basketball practice, the purpose of which is to gradually learn to adapt to the loss of strength. This is also the principle necessary to adhere to when using weight training as an off season complement to any athletic competition necessitating

projectile accuracy.

Additional temporary effects are observable in the decrement in performance evident from the end of one season to the beginning of the next, or which occur during layoffs brought about by pathology. Disuse atrophy cannot be discarded as a probable contributory cause for a lack of performance retention in accuracy skills.

SELECTED BIBLIOGRAPHY

Beritashuils, I. S. — Brain Mechanisms from Progress in Brain Research, Vol. I. Amsterdam: Elsevier Publishing Company, 1963

Brose, D.E. and M.S. Hanson — "Effects of Overload Training on the Velocity and Accuracy of Baseball Throwing," Research Quarterly, 38.4 (1967), 528-533

Cratty, B.J. — Movement Behavior and Motor Learning. Philadelphia, Lea and Febiger, 1973

Henry, F.M. and D. E. Rogers — "Increased Response Latency for Complicated Movements and a "Memory Drum" Theory of Neuromotor Reactions, Research Quarterly, 31:3 (1960), 448.

Martiniuk, R.G. — Informative Processing in Motor Skills, New York, Holt, Rinehart and Winston, 1976

Pew, R. W. — "Acquisition of Hierarchial Control Over the Temporal Organization of a Skill", Journal of Experimental Psychology, 71 (1966), 771

Schmidt, R.A. — Motor Skills New York: Harper and Row, 1975

Sechenov, I.M. — Reflexes of the Brain, Cambridge, Mass; The M. I. T. Press, 1965.

Smith, K. V. and Wm. M. Smith — Perception and Motion: An Analysis of Space Structured Motion, Philadelphia and London, W. B. Saunders Co., 1962

Van Huss, W.D. and Others — "Effects of Overload Warm Up on the Velocity and Accuracy of Throwing" Research Quarterly, 33:3 (1962) 472-475